

Guidelines for the August 2022 Applied Statistics Qualifier

STA 590

1. Textbook

Applied Linear Statistical Models, 5th edition, by Kutner, Nachtsheim, Neter, and Li

2. Chapters Covered

- a. Chapter 12.1 thru 12.5 Autocorrelation in Time Series Data
- b. Chapter 13.1 thru 13.5: Nonlinear Regression. Neural Networks are NOT covered.
- c. Chapter 14.1, 14.3 thru 14.10: Logistic Regression.
- d. Chapter 16.1 thru 16.8: Single Factor Studies (One Way ANOVA)
- e. Chapter 17.1 thru 17.7: Analysis of Factor Level Means
- f. Chapter 18.1 thru 18.3, 18.5, 18.6 : ANOVA Diagnostics
- g. Chapter 19.1 thru 19.10: Two-Factor Studies
- h. Chapter 21.1 thru 21.5 Randomized Complete Block Designs
- i. Chapter 22.1 thru 22.3 Single Factor Analysis of Covariance

This is a closed book exam with no textbook, notes, or internet assistance. A graphing calculator is permitted similar to a TI-83 or TI-84. Scratch paper will also be provided.

There will be three problems each with their own data set. These data will be presented in an Excel Spreadsheet format and will be provided to the student at the start of the exam. The student may use either Minitab or SAS for the analysis.

Students will include their software output, any written software programs, and analysis answers so the committee can see exactly what steps were taken to arrive at the results. Students will be graded on selecting the correct analysis procedures, using proper analysis techniques for that procedure, and clearly stated responses to the questions. The student's submission should be organized such that each problem is presented, with appropriate supporting documents, separately collated.

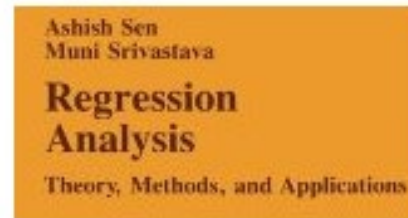
1. Textbook

Regression Analysis

Theory, Methods, and Applications

Authors: Ashish Sen, Muni Srivastava

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2. Chapters Covered

- 1 Introduction
- 2 Multiple Regression
- 3 Tests and Confidence Regions
- 4 Indicator Variables
- 5 The Normality Assumption
- 6 Unequal Variances
- 8 Outliers and Influential Observations
- 10 Multicollinearity

3. References

A.1 Addition and Multiplication.- A.2 The Transpose of a Matrix.- A.3 Null and Identity Matrices.- A.4 Vectors.- A.5 Rank of a Matrix.- A.6 Trace of a Matrix.- A.7 Partitioned Matrices.- A.8 Determinants.- A.9 Inverses.- A.10 Characteristic Roots and Vectors.- A.11 Idempotent Matrices.- A.12 The Generalized Inverse.- A.13 Quadratic Forms.- A.14 Vector Spaces.- Problems.- B Random Variables and Random Vectors.- B.1 Random Variables.- B.1.1 Independent Random Variables.- B.1.2 Correlated Random Variables.- B.1.3 Sample Statistics.- B.1.4 Linear Combinations of Random Variables.- B.2 Random Vectors.- B.3 The Multivariate Normal Distribution.- B.4 The Chi-Square Distributions.- B.5 The F and t Distributions.- B.6 Jacobian of Transformations.- B.7 Multiple Correlation.- Problems.- C Nonlinear Least Squares.- C.1 Gauss-Newton Type Algorithms.- C.1.1 The Gauss-Newton Procedure.- C.1.2 Step Halving.- C.1.3 Starting Values and Derivatives.- C.1.4 Marquardt Procedure.- C.2 Some Other Algorithms.- C.2.1 Steepest Descent Method.- C.2.2 Quasi-Newton Algorithms.- C.2.3 The Simplex Method.- C.2.4 Weighting.- C.3 Pitfalls.- C.4 Bias, Confidence Regions and Measures of Fit.- C.5 Examples.- Problems.- Tables.- References.- Author Index.